

AU/ACSC/SMITH, B./AY15

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

The Future of Naval Maneuver

by

Benjamin M. Smith, LCDR, USN

A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements for the Degree of

MASTER OF OPERATIONAL ARTS AND SCIENCES

Advisor: Col Brian T. Beckno

Maxwell Air Force Base, Alabama

August 2015 / June 2016

Disclaimer

Digital Collections

The views expressed in this academic research paper are those of the author(s) and do not reflect the official policy or position of the US government or the Department of Defense. In accordance with Air Force Instruction 51-303, it is not copyrighted, but is the property of the United States government.

Abstract

The evolution of carrier aviation has changed naval warfare and joint warfare in profound ways. This evolution has been heavily influenced by the wars the United States has faced since World War II, resulting in a strategic decision to prioritize sortie generation rate and payload over range. In the current environment, with the challenge of Anti-Access/Area Denial (A2/AD) networks designed specifically to counter the carrier, this decision has the potential to dramatically limit the effectiveness of US power projection and combat capability. Specifically, the carrier is too valuable to loose, and combatting a sophisticated A2/AD network such as China's with current aircraft inventory requires putting the carrier at significant risk.

One solution to this dilemma is to develop a new ship class specifically designed for A2/AD network penetration that will also be able to perform many of the missions of current surface combatants. A nuclear cruiser built on the LPD-17 hull would be capable of self-defense in this challenging environment and capable of massive long range strike with cruise missiles to degrade the A2/AD network. This would allow carriers to enter the fight with less risk and with an ultra-capable escort already present. As a power projection platform, it could be used in the place of a carrier in a variety of circumstances at a lower cost. It would additionally be able to perform many of the functions currently performed by a carrier's escorts, requiring fewer ships to complete a mission and therefore yielding further cost savings. Making the cruiser nuclear powered would allow it to operate independently without the risk of refueling in a hostile environment.

¹Since ancient times, navies have been as important to national military power and the conduct of warfare as armies. Public sentiment tends to focus on events such as the Spartan stand enshrined in the movie *300*, but many forget that the Persian army was actually starved out by a Greek naval blockade. Histories of Rome tend to focus on the legions while forgetting that its navy enabled Rome's defeat of Carthage, domination of the Mediterranean basin, and rise as the dominant world power. Britain established itself as a world empire almost exclusively through its superior navy, aided by geographical isolation of the homeland. Once maritime trade became a dominant economic force, naval domination became a prerequisite to becoming a world power. Maritime trade had to be defended, and other navies had to be dominated. The mobility advantage of using ships to move troops added a new element to land warfare as well, extending the reach of empires.

Naval warfare evolved over these millennia as technology changed in both weapons and ship construction. Gunpowder, steel ships, steam propulsion, and other advances provided a significant edge to nations willing to invest in these technologies for their navies. This advantage remained until a rival invested in similar technologies and restored the status quo. However, in spite of major technological advancement, the basic principles of naval warfare were largely unchanged; naval battles involved ships fighting each other in relatively close proximity in direct engagement, whether with boarding parties, fire, or guns. From the earliest naval warfare until the Dreadnaught age, this was the essence of naval warfare.

The introduction of the aircraft carrier and its use in World War II changed the face of naval warfare more than any previous technological advance, as it fundamentally changed the nature of war at sea in much the same way that airpower changed the face of warfare on land. Ships could now conduct battle well out of sight of one another and without engaging in direct

fire. Additionally, the introduction of aircraft in both the sea and land warfare domains blended the lines previously defined by the littorals in ways no earlier technology could. Aircraft from land could now attack targets hundreds of miles at sea, while aircraft from ships could attack targets hundreds of miles inland. The success and flexibility of this new technology resulted in its wholesale adoption by the US Navy.

These technologies and the resulting strategies have resulted in the state of the US Navy today, which is unarguably the most powerful navy ever to take to the seas. The centerpiece is the carrier strike group, delivering its air wing (CVW) anywhere on the globe. The CVW provides a self-contained and rapidly deployable battle force to the combatant commander (CCMD) that can readily project power both at sea and ashore in support of the six joint functions discussed in JP 3-0. The mobility, power, and sustainability of the carrier strike group make it the force of choice for the United States; frequently, the first question asked in a crisis is, “Where is the closest carrier?” Clearly, the addition of airpower to the naval domain has been a success.

The history of naval warfare shows, however, that past success does not always predict future dominance. Current US naval acquisition strategy has largely focused on current small wars in which US air and naval superiority is relatively unchallenged. Specifically, the navy has decided to accept the risk associated with prioritizing sortie generation rate and payload over range. The unrefueled range of a CVW strike has reduced from around 800nm for the F-14/A-6 airwing to more like 400-500nm for the F/A-18 airwing. Acceptance of this risk was originally based on the demise of the Soviet threat at the end of the Cold War. As the only remaining superpower, the US could assume the air superiority required for refueling closer to the target if greater range was required.² This decision has allowed unsurpassed firepower to be applied in

small to medium sized conflicts throughout the last 20 years in which carriers have operated in very close proximity to the nation targeted or relied on Air Force refueling assets in order to deliver enormous quantities of ordnance in a very short period of time, overwhelming enemy command and control (C2) systems and paving the way for further operations as required, including ground operations.

Other nations have not simply accepted US dominance, however. Both Russia and China have developed significant missile capabilities, submarine fleets, and land-based aircraft to exclude carrier operation near their shores. China, in particular, has capabilities with a range of around 1,000nm, clearly requiring the carrier to operate within the threat envelope to launch unrefueled strikes.³ Coupled with an integrated air defense system that makes refueling risky within 500nm of the coast, China can make the cost of a strike from the CVW very high. These technologies are not capable of projecting power like the US carrier force, but they are a very cost effective way for these nations to challenge US dominance in a particular battlespace near their shores. The DF-21D is of particular concern, as it is potentially easier for the Chinese to protect and is harder for US forces to defend against than cruise missiles or submarines.⁴ With the addition of maneuverable warheads making defense against this weapon difficult to impossible, the US is left with the choice of putting carriers at risk or not operating in the East and South China Seas.⁵ Current strategy largely relies on a combination of concealing the carrier's location, which is highly problematic given Chinese electronic surveillance and over-the-horizon radar capabilities (range of over 1,800nm).⁶

Continuing the strategy of prioritizing sortie-count over range requires an assumption of the continued lack of a credible threat to the carrier. While this seemed a safe assumption following the Cold War, the assumption is no longer valid. The increased capabilities outlined

above clearly indicate that the anti-access/area denial (A2/AD) threat is real, especially from China. The only remaining support for this assumption is that the cost of attacking the US is too great. In his article on the DF-21D, Robert Farley argues that the DF-21D is a deterrence weapon that is unlikely to be used because the cost to the US of losing a carrier would likely spark a greater conflict.⁷ This argument, openly couched in the nuclear deterrence theory of the Cold War, is fundamentally flawed in that it requires an assumption of US nuclear response to the use of conventional weapons against US forces. In reality, the only way to ensure the safety of US carriers is not to allow them to enter the A2/AD environment, removing the threat to the nation in question. Farley is correct, however, in his assessment that an attack on a carrier would be intolerable to the US and lead to escalation. Jerry Hendrix points this out clearly, stating, “They are too valuable to lose. At \$14 billion apiece, one of them can cost the equivalent of nearly an entire year’s shipbuilding budget. (Carriers are in fact funded and built over a five-year period.) The cost of losing a carrier would not be only monetary as each carrier holds the population of a small town. Americans are willing to risk lives for important reasons, but they have also become increasingly averse to casualties. Losing a platform with nearly 5,000 Americans onboard would not just raise an outcry, but would undermine public faith in elected officials — and the officials know it. It would take an existential threat to the homeland to convince leaders to introduce carriers into a high-threat environment.”⁸ Deterrence favors the nation employing A2/AD in this scenario and not the United States.

Thus, the combination of advancing adversary technology, the value of a carrier, and reduced air wing range has led the United States to a situation in which the Navy’s primary tool for rapid power projection is optimized for small conflicts but almost useless in a great power conflict. Hendrix advocates in another work, “Retreat from Range”, that CVW composition be

altered to allow greater range to mitigate the risks currently being realized.⁹ While his proposal for longer ranged aircraft, both manned and unmanned, to extend the range of the air wing would help, it does not solve the problem. Extending the range of the air wing to approximately the range of adversary A2/AD systems simply forces the extension of those systems. Hendrix admits as much later in the article quoted above.

Additionally, increased use of carriers in smaller conflicts has precluded necessary maintenance, resulting in a reduced state of readiness. Fully half of US carriers were in extended maintenance availabilities or overhaul and unavailable for use in the fall of 2015. The Navy is already asking leaders to choose between maintaining these assets for future use or employing them now. Gaps in the carrier presence requested by Combatant Commanders (CCDR) are already occurring. With no margin for error in this delicate balance between maintenance and deployment, difficult decisions would have to be made in dealing with any further crisis.¹⁰ Any further strain could result in a future period in which carriers would not be available to meet the needs of a CCDR in a major conflict.

The solution to these difficult challenges requires innovative thinking and departure from accepted norms, as revolutionary transformation usually does. However, Occam's Razor is still germane; the simplest solution is likely the best. In summary, the United States requires a counterstrategy to great power A2/AD strategies that is survivable, available, deployable, and cost effective while still also useful in smaller conflict scenarios. A new class of cruiser based on existing technologies used as both a carrier escort and as an independent deployer would both augment protection of the carrier and provide greater numbers of power projection assets at a lower cost. The LPD-17 hull, nuclear propulsion, the AN/SPY-6 radar (also known as air and missile defense radar, or AMDR), current missile systems in greater quantity, including standard

missile technology and tomahawk land attack missiles (TLAM), and anti-submarine warfare (ASW) capabilities are several of the key technologies that should be incorporated into this design. The discussion below will first focus on proposed design, including the advantages and disadvantages of each factor, and then will discuss the advantages of the overall package including potential employment.

The choice of the LPD-17 hull provides several advantages. First, it is a proven hull design that can be used with little additional cost, as compared to a new design. Second, it already contains significant staff planning and operations spaces, allowing it to perform many of the command functions normally located on the carrier. This enhances its capability as an independent deployer as well as allowing flexibility for strike group staff when functioning in an escort role. The staff could relocate to the cruiser and maintain full communications capability while the carrier uses emissions control to remain unlocated. Third, it contains the necessary size for extensive weapons systems, including additional missile launchers, and propulsion systems that destroyer (DDG) hulls simply do not allow. Finally, it already incorporates radar cross section (RCS) reduction and improved blast survivability that would make the new ship class even more effective in an A2/AD environment. These features are the reason that Huntington-Ingalls has proposed a Flight II LPD-17 class that would perform some of the functions discussed later.¹¹ However, their design has significant limitations that make it less strategically and tactically useful than the design proposed here.¹²

Nuclear propulsion is likely the most controversial part of this proposal, largely due to its cost. Nuclear powered cruisers were used as carrier escorts in the past, but they proved too expensive to operate and were removed from service shortly after the Cold War. Conventionally powered ships were simply more cost effective. However, based on the findings of a recent

Congressional Budget Office (CBO) report, building 12 new LPD class ships (similar to LPD-17) would cost approximately \$14.8 billion for their entire life cycle.¹³ Compared to the procurement (vice life cycle) cost of a single FORD class carrier at \$13 billion, if this new cruiser capability could allow the reduction in force of even one carrier, the cost savings would be significant.¹⁴ Obviously, the increased cost of technology and weapons systems would increase the cost of this cruiser over an LPD, as shown by the higher cost of a nuclear DDG cited in the CBO report. However, even if the per-unit cost of a nuclear DDG and a nuclear LPD are added to estimate the cost of this cruiser (likely a significant overestimation), it still would be only around \$3 billion, allowing 4-5 cruisers to replace one carrier at breakeven cost, not counting the cost of the carrier's escorts. This is clearly a cost effective course of action if the capabilities and employment of the cruiser allow for a reduction in the carrier force.

The benefit for this higher cost of nuclear propulsion cannot be overstated, however. A conventionally powered cruiser operating in an A2/AD environment would need to be refueled every one to two weeks, an operation that may require coming off station to reduce the risk to the refueling ship. For the same reason that carriers are nuclear powered, the new cruiser class must also be nuclear powered. Additionally, the power generation capacity of a nuclear power plant would allow for addition of future power-intensive technologies that cannot be used on current surface combatants. Finally, the additional power provided by nuclear propulsion would allow greater speeds than those currently achievable with the LPD-17, rivaling the ability of a carrier to quickly reach an operating area without regard to refueling requirements.

The AN/SPY-6 radar is the Navy's newest and most capable air and missile defense sensor, scheduled for installation on both the FORD class carriers and Flight III DDGs. However, significant questions regarding its capability as adapted to the DDG exist. A recent

report from the Congressional Research Service indicates that due to size constraints, the DDG version of the radar is less capable than the one that would be installed on the cancelled CG(X) class, but is assessed to be capable of meeting threat requirements. However, some disagreement on this assessment exists, including assessments that not enough research has been done to ensure adequate capability.¹⁵ This new cruiser class would provide sufficient space, power, and cooling capacity to support the larger version of the radar and ensure adequate capability both for self defense and for force defense as a carrier escort. In fact, the LPD-17 hull may even be large enough to support an even more capable version than planned for CG(X). Due to the scalable nature of the radar, increasing this capability will have minimal cost.¹⁶

As the LPD-17 hull has far more surface area available than that of a DDG, more Vertical Launch Systems (VLS) can be installed, allowing for a greater missile capacity than currently available on any platform. The notional design for the Flight II has 288 cells while retaining helicopter capability.¹⁷ For air and missile defense, a highly capable missile will be required as well, and the SM-6 meets this requirement. Capable of both Sea Based Terminal ballistic missile defense and cruise missile defense, this missile represents the state of the art. While inclusion of this missile does not provide any greater capability than a DDG Flight III similarly equipped, its use reduces cost as compared to developing a class-unique missile. The additional capacity allowed by the LPD-17 hull would make this platform more survivable in the A2/AD environment than anything in the current inventory. Using the same VLS also allows for continued use of the SM-3 for ballistic missile mid-course intercept, providing employment options to the CCDR. Additionally, TLAM can also be used from the VLS, allowing an enormous prompt strike capability that would rival the capability of a CVW for several days. Finally, the available magazine space, including well deck space that would not be used for the

cruiser and could be converted to magazines, would allow for significant storage of a variety of missiles. LPD-17 has sufficient size to allow both the machinery and stability necessary for reloading missiles at sea, a capability that DDGs lack. As a result, the strike capability is further increased, and change in mission configuration based on the threat is possible at sea.

For ASW, most of the existing technologies employed on CG and DDG class ships can be used unaltered or improved versions installed. Towed array sonar, NIXIE, and over the side torpedoes should all be included in the design. Vertically launched anti-submarine rockets will still be available for loading in the VLS. Over the side torpedoes could also be included. The LPD-17 hull allows for significant helicopter capacity, so aviation ASW capability is available, depending on aircraft actually deployed. The LPD-17 hull thus equipped is far less vulnerable to submarine attack than a carrier, making it far superior in the A2/AD environment.

The new cruiser would additionally maintain all of the current capabilities of the DDG and CG classes, including electronic warfare, search and rescue, and maritime interdiction (including visit, board, search, and seizure). For anti-surface warfare, the currently used 5-inch gun could be fitted, or a new, larger gun could be designed. A more capable anti-ship cruise missile to replace the Harpoon that is launched from the vertical launch system should be included. Aircraft capacity for either helicopters or RPA would be increased. These increased or equivalent capabilities, while advantages as compared to a DDG, increase the utility of the proposed platform, but do not contribute to the A2/AD solution and are thus only briefly mentioned here.

In terms of employment, three basic options are available. The first is as an independent deployer. This option gives the CCDR a fully capable surface combatant that is both survivable in the A2/AD environment and has sufficient initial strike capability to serve as a significant

deterrent in lieu of a carrier. This is likely a significant enough deterrent in many cases at a far lower cost than a carrier strike group. When a DDG is not enough deterrence, the only present option is to send a carrier. If a carrier is too much, no in between option is available. In such a case, the cruiser described here provides such an option, potentially reducing the number of carriers required overall.

The second employment option is as a forward deployed deterrent with a carrier strike group in reserve. For example, a cruiser in the Arabian Gulf and another in the South China Sea with a carrier strike group in reserve somewhere in the Pacific or Indian Oceans, even if in port, would likely provide sufficient coverage prior to the start of hostilities. In the event of a contingency requiring immediate response, the cruiser on station would begin TLAM strikes to begin degrading A2/AD and/or C2 networks while the carrier transits at high speed. On the carrier's arrival, the cruiser becomes the carrier escort (it would have outrun the rest of the strike group), and operations continue from that point as they would if the carrier were on station from the beginning. The primary advantage of this option is that it requires only one carrier and two cruisers to cover what currently requires two carriers, at significantly reduced cost. Additionally, the cruiser would have already degraded the A2/AD network before the carrier arrives, allowing carrier operation in the contested environment with far lower risk.

The third employment option is a carrier strike group with the new cruiser as the primary escort configured primarily for missile defense. The increased capacity of this new design provides a far more capable defense than would be available from a DDG. Increased berthing and staff space on the cruiser would allow the strike group staff to shift to the cruiser, maintaining communications while allowing the carrier to operate in emissions control. This increases the likelihood that the carrier remains unlocated while C2 functions are largely

unhindered. Line of sight radio and network capability would allow communications with the carrier, including tactical picture data that would permit almost all carrier operations without the use of organic sensors. This capability greatly reduces risk to the carrier, allowing for deployment into the A2/AD environment, though at increased cost as compared to a conventional strike group. This option would likely only be used on the brink of great power hostilities, however, a time at which cost is less of a concern than mission success. A second or third cruiser primarily configured for strike could also be added to increase overall capability at a lower expense and lower risk than a second carrier. Additionally, with the use of the E-2D and Cooperative Engagement Capability, the SM-6 could be used against both air and surface targets over the horizon to defend the CVN at greater range.

Given the configuration described above, the new cruiser class will be far more capable of operating in the A2/AD environment than a carrier. Its lower radar cross section and lack of air traffic control radars will make it harder to locate and target. In terms of capability, while an aircraft carrier can clearly deliver a far greater quantity of ordnance, the cruiser would provide an adequate response to most crises, particularly with the availability of a carrier in reserve. In terms of cost, the above analysis shows that two cruisers could replace the deterrence function of a carrier at a significantly lower cost. If the carrier force were dropped from ten to eight and six of the proposed cruisers were procured, the cost savings would exceed \$11 billion. This cost savings does not include the savings from eliminating two CVWs, the lower manning required for the cruisers (6 cruisers with a crew of 400 each would require less manning than just one of the eliminated carriers), or the potential for reducing the number of destroyers and conventionally powered cruisers that currently are required as escorts. This force structure would

deliver an overall increase in capability against both the A2/AD threat and low intensity conflict requiring only minimal strike capability at a significantly reduced cost to taxpayers.

The history of naval warfare is a long story of technical innovation by one navy requiring response by others. Most of the time, these arms races have resulted in all major navies adopting similar technologies in various quantities. The addition of airpower to the naval domain changed this trend in profound ways, blurring the line between land and sea, and allowing for true multi-domain combat. The high cost of modern technology, however, has resulted in an asymmetric environment based on national objectives. While the United States has largely relied on the aircraft carrier for global power projection, her primary great power competitors have increasingly relied on A2/AD strategies for their regional dominance goals. The sophistication of these A2/AD systems threatens the viability of current US strategy, requiring further innovation to protect US interests. This proposed new class of cruiser will meet that requirement in a way that reduces risk to US assets, increases power projection and presence capability, and reduces cost. Further study should commence immediately to validate the viability and practicality of this option and to explore other technologies not considered here to further increase the capability of this cruiser, which should step alongside the carrier as the centerpiece of the future US Navy.

¹ I wish to thank Major Humphrey for her thoughtful comments and suggestions. All errors found herein are my own.

² Hendrix, “Retreat from Range”, 45-46. <http://www.cnas.org/retreat-from-range#.Vt77aDZf2is>

³ Hendrix, “Retreat from Range”, 4.

⁴ Farley, <http://nationalinterest.org/feature/should-america-fear-chinas-carrier-killer-missile-11321>.

⁵ Fisher, <http://www.janes.com/article/58013/china-reveals-df-21-mrbm-manoeuvrable-warhead>.

⁶ Liu, 74. <http://www.dtic.mil/dtic/tr/fulltext/u2/a474069.pdf>

⁷ Farley.

⁸ Hendrix, <http://www.nationalreview.com/article/417306/age-aircraft-carrier-over-jerry-hendrix>.

⁹ Hendrix, “Retreat from Range”, 50-61.

¹⁰ Eckstein, <http://news.usni.org/2015/11/04/navy-half-the-carrier-fleet-tied-up-in-maintenance-other-5-strained-to-meet-demands>.

¹¹ Huntington-Ingalls, <http://www.huntingtoningalls.com/flight2/compare>

¹² Katzman, <https://www.defenseindustrydaily.com/cat/electronics-it/it-general/feed/>

¹³ CBO, 6.

¹⁴ O’Rorke, Ford Class Carrier Program 6.

¹⁵ O’Rorke, Destroyer Programs, 16-22.

¹⁶ Raytheon, <http://www.raytheon.com/capabilities/products/amdr/>

¹⁷ Katzman.

Bibliography

Hendrix, Jerry. *Retreat from Range*. (Washington, DC; Center for New American Security, 2015). Available online at <http://www.cnas.org/retreat-from-range#.Vt77aDZf2is>

Farley, Robert. "Should America Fear China's Carrier Killer Missile." *The National Interest*, 22 September 2014, <http://nationalinterest.org/feature/should-america-fear-chinas-carrier-killer-missile-11321>.

Fisher, Richard D. "China Reveals DF-21MRBM Maneuverable Warhead." *HIS Jane's 360*, 14 February 2016, <http://www.janes.com/article/58013/china-reveals-df-21-mrbm-manoeuvrable-warhead>.

Liu, Bin-Yi. "HF Over the Horizon Radar System Performance Analysis." Master's thesis, Naval Postgraduate School, 2007. Available at <http://www.dtic.mil/dtic/tr/fulltext/u2/a474069.pdf>

Hendrix, Jerry. "The U.S. Needs to Radically Reassess How It Projects Power." *National Review*, 4 May 2015, <http://www.nationalreview.com/article/417306/us-navy-needs-radically-reassess-how-it-projects-power-jerry-hendrix>.

Eckstein, Megan. "Navy: Half the Carrier Fleet Tied Up in Maintenance, Other 5 Strained to Meet Demands." *USNI News*, 4 November 2015, <http://news.usni.org/2015/11/04/navy-half-the-carrier-fleet-tied-up-in-maintenance-other-5-strained-to-meet-demands>.

Huntington-Ingalls Industries. "Flight IIA vs. LPD 17." Huntington-Ingalls Industries. <http://www.huntingtoningalls.com/flight2/compare> (accessed 8 March 2016).

Katzman, Joe. "LPD 17 SAN ANTONIO Class: The USA's New Amphibious Ships." *Defense Industry Daily*, 14 January 2016, <https://www.defenseindustrydaily.com/cat/electronics-it/it-general/feed/>.

Congressional Budget Office. *The Cost-Effectiveness of Nuclear Power for Navy Surface Ships*. Washington, DC: Congressional Budget Office, May 2011. Available online at <https://www.cbo.gov/publication/41454>.

O'Rorke, Ronald. *Navy FORD (CVN 78) Class Carrier Program: Background and Issues for Congress*. Washington, DC: Congressional Research Service, 12 June 2015. Available online at <http://news.usni.org/2015/06/23/document-report-to-congress-on-gerald-r-ford-carrier-program>.

O'Rorke, Ronald. *Navy DDG-51 and DDG-1000 Destroyer Programs: Background and Issues for Congress*. Washington, DC: Congressional Research Service, 17 December 2015. Available online at https://www.researchgate.net/publication/228396224_Navy_DDG-51_and_DDG-1000_Destroyer_Programs_Background_and_Issues_for_Congress.